AEC-NASA TECH BRIEF

Practical New Method of Measuring Thermal-Neutron Fluence

The problem:

The previous method of measuring thermal-neutron fluence required exposing gold, indium, or cobalt foils to a neutron environment. Thermal-neutron fluence, ϕt, is the term used to describe the time integral of neutron particle intensity, which is equivalent to the quantity *nvt* used in neutron physics. The units of fluence are n/cm^2. Upon becoming radioactive, the foils are put adjacent to nuclear dosimeters for fluence measurement. This method is hazardous and not sufficiently accurate. Moreover, it is inconvenient because of the short half-life of the foils.

The solution:

Replacement of the nuclear dosimeter method with a thermoluminescence dosimeter technique.

How it's done:

Isotopic multicrystalline Li^6F_2 phosphor powder is encapsulated and exposed to the neutron environment. The resultant absorption of thermal neutrons is directly proportional to the number of available neutrons. The capsule is then placed in a commercially available Thermoluminescent Dosimeter Reader where it is first heated to a specified temperature. This results in light emission which is proportional to the neutron fluence, and which is plotted on a strip-chart recorder integral to the Reader.

Notes:

1. The previous sensitivity was limited to 10^6 to 10^{12} n/cm^2. This new method yields a sensitivity of 10^3 to 10^{12} n/cm^2—a three decade improvement.
2. Since the Li^6F_2 powder does not become radioactive it presents no handling problems. Once exposed it can be stored indefinitely, permitting readout at the user's convenience. In contrast, the gold foil half-life is 2.8 days.
3. This technique could be applied to medicine, power reactor technology, and nuclear shipboard instrumentation.
4. Inquiries concerning this innovation may be directed to:

   Technology Utilization Officer
   AEC–NASA Space Nuclear Propulsion Office
   U.S. Atomic Energy Commission
   Washington, D.C. 20545
   Reference: B67-10352

Patent status:

No patent action is contemplated by AEC or NASA.

Source: E. A. Warman and J. R. Siebold
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